

COIL SPRING DESIGN

Assume torsional modules of elasticity.

Load = 80lb., Mean Spring Diameter = 1.5", C = 11, 500,000 psi.

Assume allowable working stress's = 60,000 psi

$$d = 3 \frac{PD}{0.3S} \quad d = \sqrt[3]{\frac{80 \times 1.5}{0.3 \times 60,000}} = .188" \text{ Try No. 6 wire} = .192 \text{ inches}$$

Find Wahl Factor $K = \frac{4C - 1 + 0.615}{4C - 4}$ Trial wire size $C = \frac{D}{d} = \frac{1.5}{.192} = 7.8$ inches = Wahl Factor

$$S = \frac{8PDK}{3} = \frac{8 \times 80 \times 1.5 \times 1.19}{3 \times 3.1416 \times (.192)} = 51,500 \text{ psi stress less than 60,000 psi}$$

Use # 7 Wire

$$f = \frac{3}{4} \frac{(8PD)}{Gx(d)} = \frac{3}{4} \frac{8 \times 80 \times (1.5)}{11,500,000 \times (0.177)} = 0.191"$$

Assume clearance between loaded coils = 1/16"

Then Pitch = L = B + f + d = 1/16" + .0191 + .192" = 0.444"

Clearance = B = L - f - d + 0.444" - 0.191 - 0.177" = .076"

Assume Solid Length is less than 1 - 7/16"

Number of coils = N = $\frac{h}{d} = \frac{1.43}{0.177} = 8$ active coils

Therefore Solid Length = h = 8 x 0.177 = 1.4"

Free Length = H = 8 x 0.444" = 3.5"

Pitch L Per Coil = of Loaded Spring = l

Pitch l per coil = L - f = 0.444 - 0.191 = 0.253"/coil

COIL SPRING DESIGN, P,2

Assume $H_w = 2.5"$ and end coils are squared.

$$N = \text{number of active coils} = \frac{H_w - 3d}{1} = \frac{2.5" - 3 \times .177}{.253} = 8 \text{ coils}$$

When $N = 8$

$$H = 8 \times .444" + 3 \times 0.177 = 4.1"$$

$$\text{Total Deflection} = N = (L-d) = 8 (.444" - .177") = 2.136"$$

Working load: Working Deflection: Maximum Load: Maximum Deflection

$$\text{Maximum Working Load} = 2.136" \times 80\text{lb}/1.53" = 112 \text{ pounds}$$

$$\text{Solid height load } P = \frac{11,500,000 \times (0.177)}{8 \times 8 \times (1.5)}^4 \times 2.136 = 112 \text{ pounds}$$

Working Stress: Maximum Stress: Working Deflection: Maximum Deflection

$$\text{Maximum Stress } S = \frac{64,500 \text{ psi} \times 112\#}{80\#} = 90,000 \text{ psi}$$

The Ratio of Mean Spring Diameter to Wire Diameter, i.e., the "Spring Index" should be between 6 and 9, wherein 9 is ideal.